

# TC1905

## "QUICK-TALK"

### TELEPHONE AND DRY CONTACT FIBER OPTIC EXTENDER

# User's Manual

MODEL: \_\_\_\_\_

S/N: \_\_\_\_\_

DATE: \_\_\_\_\_

#### Notice!

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TC Communications, Inc. 17881 Cartwright Road - Irvine, CA 92614

Tel: (949) 852-1972 Fax: (949) 852-1948 Web Site: [www.tccomm.com](http://www.tccomm.com) Email: [info@tccomm.com](mailto:info@tccomm.com)

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# Chapter 1 - Overview

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## Features

- 2-wire Analog Telephone Extender Over Fiber**
- Covers Voice Band Width from 300Hz to 3.4Khz**
- Supports One Channel of: Bi Directional Dry Contact**
- Supports One Channel of 2 or 4 Wire Analog Signals**
- Toll Voice Quality with Ringdown Capability**
- FXS or FXO switchable (when configured for FXO/FXS)**
- LEDs Indicate Volume, Ringing Status, Relay, Closure, Master, Slave and FXO/FXS**
- FPGA Technology (Field Programmable Array) Consumes Low Power**
- Stand Alone or Rackmount**

## Description

The TC1905 Phone Extender multiplexes one voice channel or one channel of 2 or 4 wire analog and one dry contact channel to a remote location over fiber optic cable. The voice channel is compatible with most analog telephones, PBXs or Key Systems. The dry contact channel is bi directional and either side can be designated as DCD (dry contact detector) or Relay.

It provides 2-wire FXS (foreign exchange subscriber) on the telephone side with ring down capability and FXO (foreign exchange office) on the PBX side. When both sides are set to FXS, a "Hot Link" can be established: when the handset on one end is lifted up, the other side rings.

When both units are set as FXS to FXS, the front DIP switch "RING CAD" can be set to ring the other party with a "cadence" instead of a straight ring.

TC1905 is typically used to phone service and a dry contact detector to remote sites up to distances of 100 km. For situations with minimal fiber availability or to maximize fiber usage, a one-fiber, bi directional version is optional.

FXS or FXO, are available on the unit. The front DIP switch is used to set the unit as FXS or FXO, and two rear panel RJ11 ports are dedicated for FXS and FXO.

One of the two units must be set as a Master with the front DIP switch "MSTR" in the "down" position. The other unit must be a "Slave" unit with front DIP switch "MSTR" set to the "up" position.

### Initiating and answering a call

Refer to the application examples on page 8 for FXO to FXS or FXS to FXS setups.

Available in standalone or rackmount, the TC1905 supports multimode (1300nm) or single mode (1300/1550nm) fiber with SC connector (ST, FC optional). Diagnostic aids include multiple diagnostic LEDs for indicating power status, ringing signal, Master status, FXS/FXO status, Dry contact detector (DCD), Dry contact relay etc. TC1901 has a built-in dry contact relay terminal block to provide external alarm.

Power is 12VDC (standard). 24VDC, -48VDC, 125VDC and 115/230VAC with an external power cube is optional. Power redundancy is standard. Electrical connectors are RJ-11 Female for both the telephone set & Dry contact. The TC1905R rackmount card version fits into 19" wide TCRM191 and TCRM195 rackmount card cages.



## Front Panel LEDs

### LEDs:

**POWER A:** When lit, a good power source is present at power jack A (rear panel).

**POWER B:** When lit, a good power source is present at power jack B (rear panel).

**VccA:** +5V Voltage indicator. This LED should light whenever power is connected to the unit. It indicates the correct operating voltage is being derived from the power source.

**VDC:** Not Used.

**ALM:** Alarm indicator. When lit on Red, there is problem with the incoming optical signal.

**OPT:** When "On" the optic signal is above sensitivity. It will flash when the optic signal is lost or below sensitivity.

**SYNC:** When lit, it indicates valid optic signal is received. When flashing, it indicates an invalid optic signal is received. This can happen when the optic receiver is over driven or the wrong optic signal is received.

**RSNC:** Remote Sync; When lit, it indicates "SYNC" LED status at the remote unit's front panel. When Off, either the remote unit didn't receive good optic signal or local unit didn't receive optic signal.

**FXS:** When lit, it indicates the RJ-11 port for FXS is activated. **Note:** Don't use both of the FXO and FXS connectors on the same unit at the same time.

When flashing, it indicates a problem with the FXS module. For temporary correction of this problem, swap the settings for the FXO DIP switch#2 on the local and remote units. If the local unit is set as FXO (DIP switch#2 down) set it as an FXS (with DIP switch#2 up) and set the remote unit as an FXO unit (with DIP switch#2 down). Bring the remote unit to the local site and take the local unit to the remote site. Be sure to let the Technical Support Department at TC Communications, Inc know about the problem at (949) 852-1973.

**FXO:** When lit, it indicates the RJ-11 port for FXO is activated.

**MSTR:** When lit, it indicates the unit is set as the "Master" of the link.

**RMTLB:** When lit, it indicates the unit's "RMTLB" switch is on. (future release).

**RING:** When lit or flashing, it indicates the following:

- 1) When set to FXS, a ring signal is received from the remote unit.
- 2) When set to FXO, a ring signal is received from the phone line.

**HOOK:** When lit, it indicates the following:

- 1) When set to FXS, the local phone is off hook.
- 2) When set to FXO, the remote unit is off hook.

**RLY:** "Relay" When lit, the solid state relay is closed (activated). Refers to the Dry Contact Relay side.

**CLS:** "Closure" When lit, the closure detection is detected. Refers to the Dry Contact Closure Detector side.

**NOTE:** The rest of the LEDs will be for future releases.

## Rear Panel and Connectors - Phone Extender

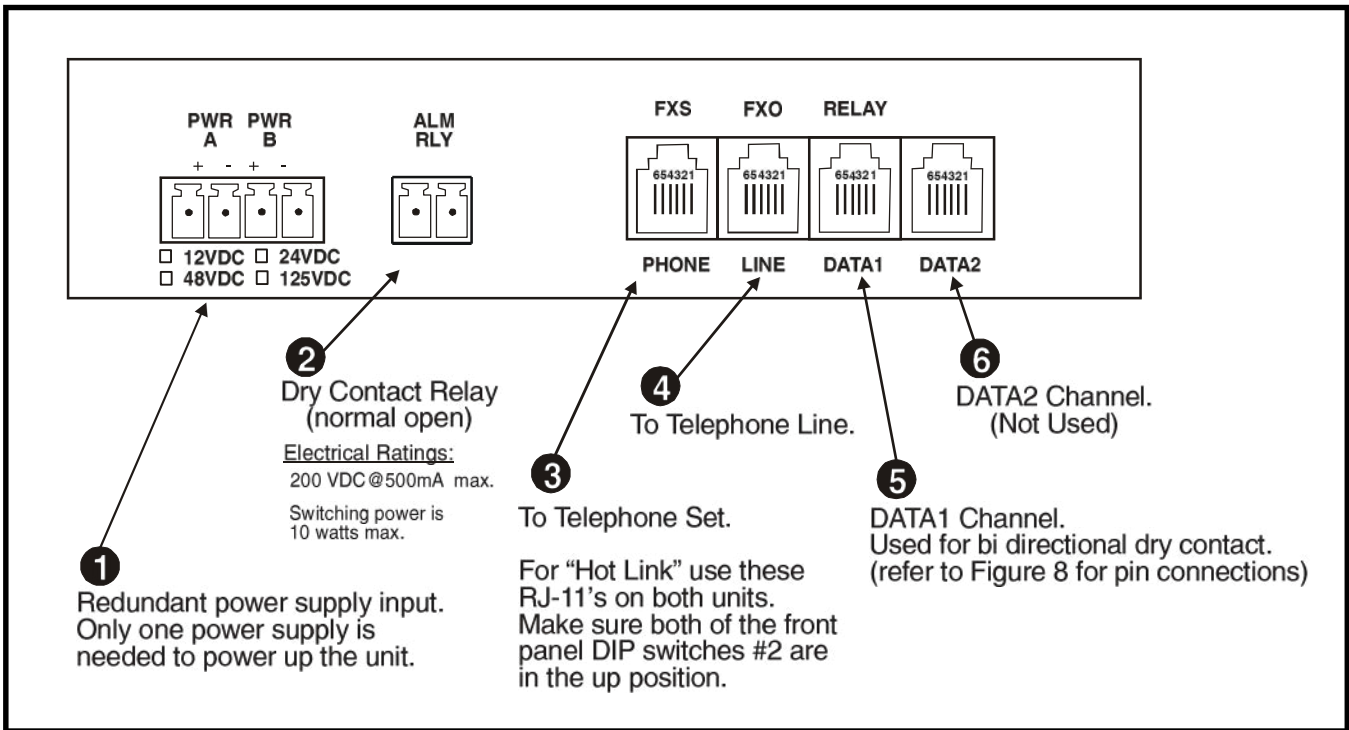


Figure 2. TC1905's Rear Panel for Phone Extender

## Rear Panel and Connectors - Analog Extender

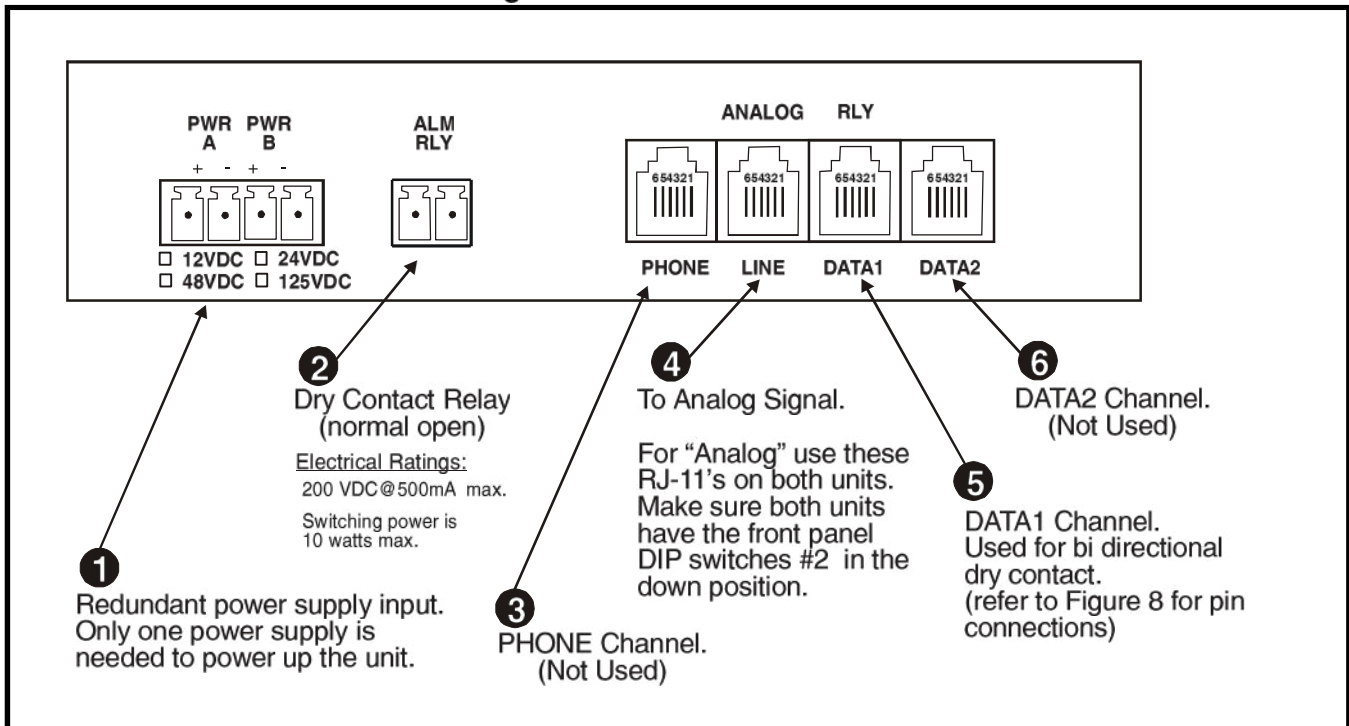


Figure 3. TC1905's Rear Panel for Analog Extender

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## **RJ-11 Connector for "PHONE"**

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Connect to a regular (conventional) 2-wire telephone. This RJ-11 is used for "FXS". If a hotlink phone line is desired, then both TC1905s should connect to this "FXS" connector.

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## **RJ-11 Connector for "LINE"**

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Use regular phone wire to connect the TC1905 to a dial up phone network such as phone line from Telco or PBX phone line. This RJ-11 jack is used for "FXO". Refer to the pin assignments on page 9.

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## **RJ-11 Connector for "ANALOG"**

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When using the Analog Interface, use this "ANALOG" RJ-11 jack to connect your 2 or 4 wire analog signal. Refer to the pin assignments on page 9

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## **RJ-11 Connector for "DATA1"**

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Channel 1 used for Bi Directional Dry Contact. (Refer to the pin assignments on Figures 9 & 10).

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## **RJ-11 Connector for "DATA2"**

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Not used.

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## **Dry Contact Relay Terminal Blocks**

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The Dry Contact Relay is normally in the "Open" position. The following conditions will activate the dry contact relay to "close" status:

1. When there is a Major Alarm (Optic signal is lost). This function can be disabled by setting the front panel SW4 to the "down" position.

The user can use the Dry Contact Relay for an additional function by enabling SW2\_3 to the On position (internal switch#2) on the FXS side unit only. This feature allows the Dry Contact Relay to close and open as the telephone set rings. The user can use it to connect an additional external device so that the user can monitor the ringing when they are away from their phone. By using this function, all the LEDs will behave normal.

## Application Example 1: Phone Line Extension

This application is to extend a phone line via fiber optic cable. Follow the connections shown in the following diagram. Connect two TC1905s via fiber optic and set one of them to FXO and the other to FXS. Connect a regular dial-up phone line to "LINE" RJ11 of the "FXO" unit and connect a telephone set to "PHONE" RJ11 of the FXS unit. To establish a call, the users at the remote end (FXS side) can pickup the phone and dial out to outside phone network just like regular telephone line extended. Make sure you set one of the units as a "Master" and the other as a "Slave".

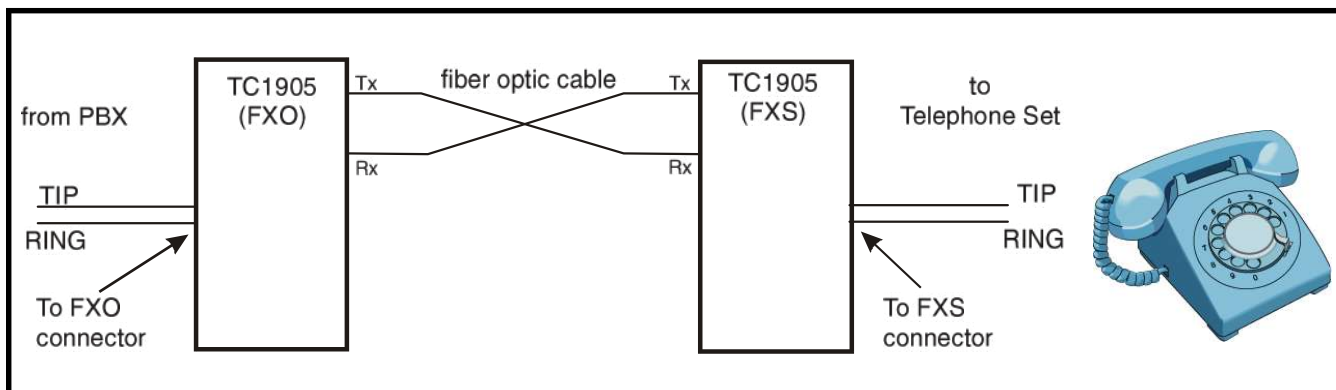


Figure 4. Typical Application Diagram - Phone Line Extender

## Application Example 2: Hotlink Phone Extension

By connecting two FXS TC1905s together using two regular telephone sets, the users at both sides of the fiber link can have a hotlink phone line setup (*both units must be set to FXS by setting the front panel dip switches #2 in the up position*). When one user lifts up the handset, the remote side phone will start to ring. When remote side user picks up the handset, the phone stops to ring and the conversation begins.

When conversation is over any user can replace the handset to hook to terminate the phone link. If either party places the handset to hook and the other does not hang up, the phone on hook will continue to ring.

NOTE: You may experience some clicking noise, this is normal until the remote side picks up the handset.

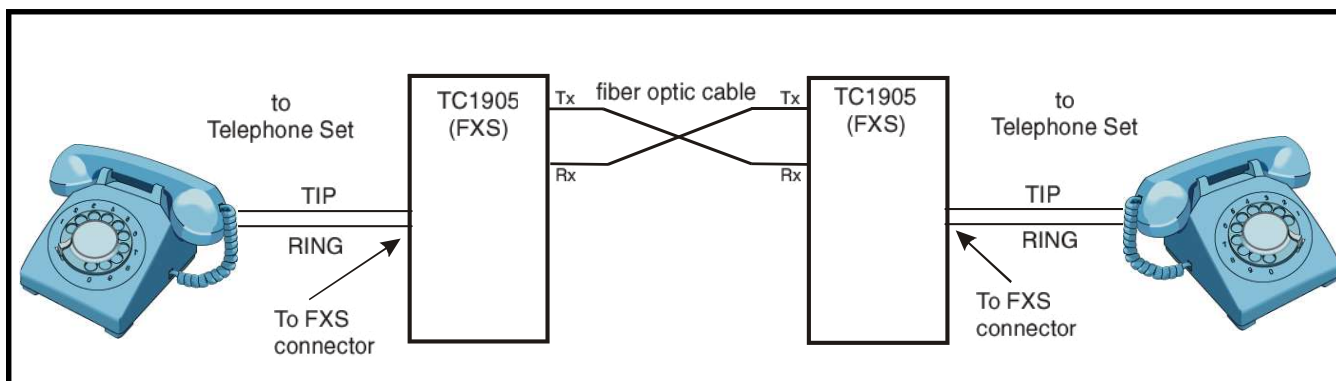
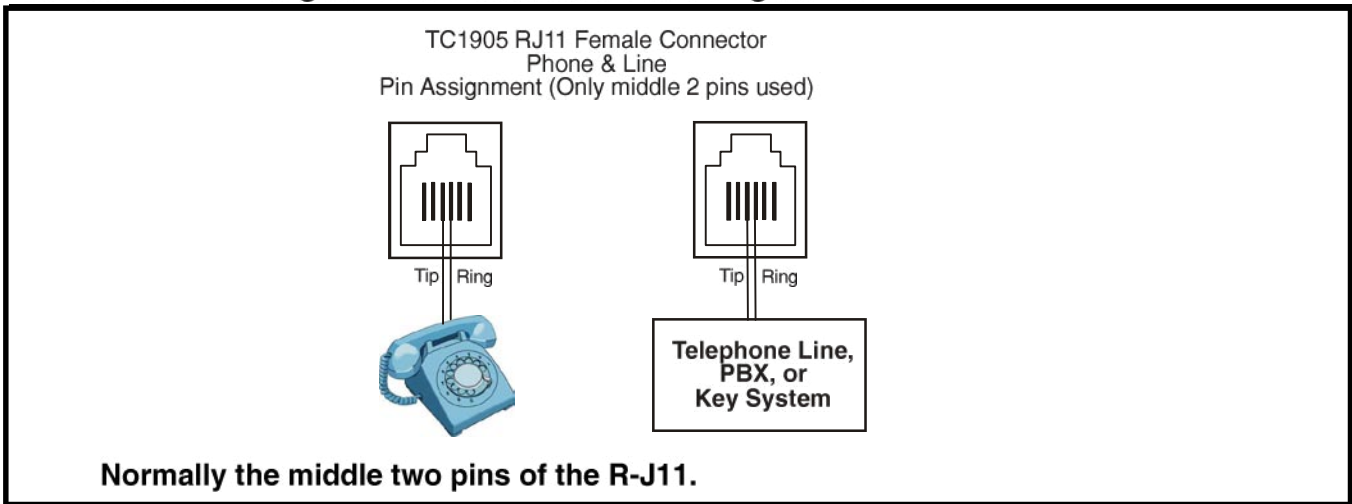


Figure 5. Typical Application Diagram for Hotlink



## Electrical Phone Signal Connection and Pin Assignment



**Figure 6. Phone/Line (RJ-11F) Connection Diagram**

Figure 6 shows how the TC1905 connects to the phone or PBX as in Figure 4 and 5. TC1905's phone Jack and Line Jack use the middle two pins to connect to telephone or PBX's Tip and Ring.

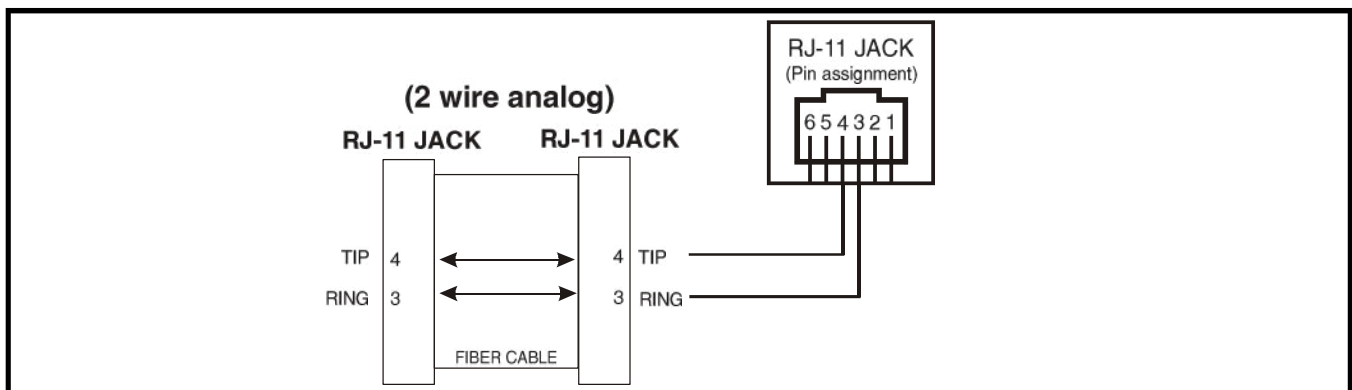
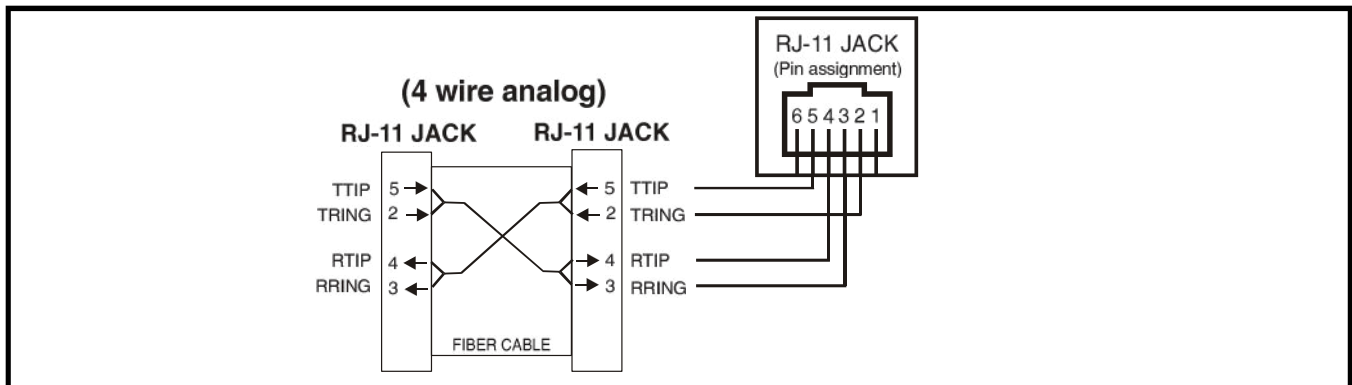
### Analog Pin Assignments

**For analog audio signals:**

Pin 5 is the transmit TIP & pin2 is the transmit RING.

Pin 4 is the receive TIP & pin 3 is the receive RING.

**Note:** When using the Analog Interface, both TC1905 units will be set by factory to FXO units by setting the front panel DIP switch #2 to the down "On" position. Use only the ANALOG RJ-11 connector's on the rear panel.



## Bi Directional Dry Contact Closure Detector & Relay Switch

For dry contact closure applications, the TC1905 can be used as either the Closure Detector or Relay depending on which pins are used. The "close" and "open" status is controlled by a relay switch inside the TC1905. It reflects the remote detector's "on" and "off" status.

The diagrams below, illustrate the virtual pin connections for using the TC1905 as either a dry contact Closure Detector or a Dry contact Relay. The RJ-11's pins 4 and 5 are closed at the Closure Detector side, the status is reflected at the remote Relay's side RJ-11's pins 2 and 3. The Relay switch is rated 0.4A DC switching current, with a max load rating of 24VA.

As an option, the Relay switch can be rated 1.8A DC switching current, and a load rating of 108VA.

(**Note:** All units will be factory configured for the 0.4A DC current rating, unless otherwise specified and ordered)

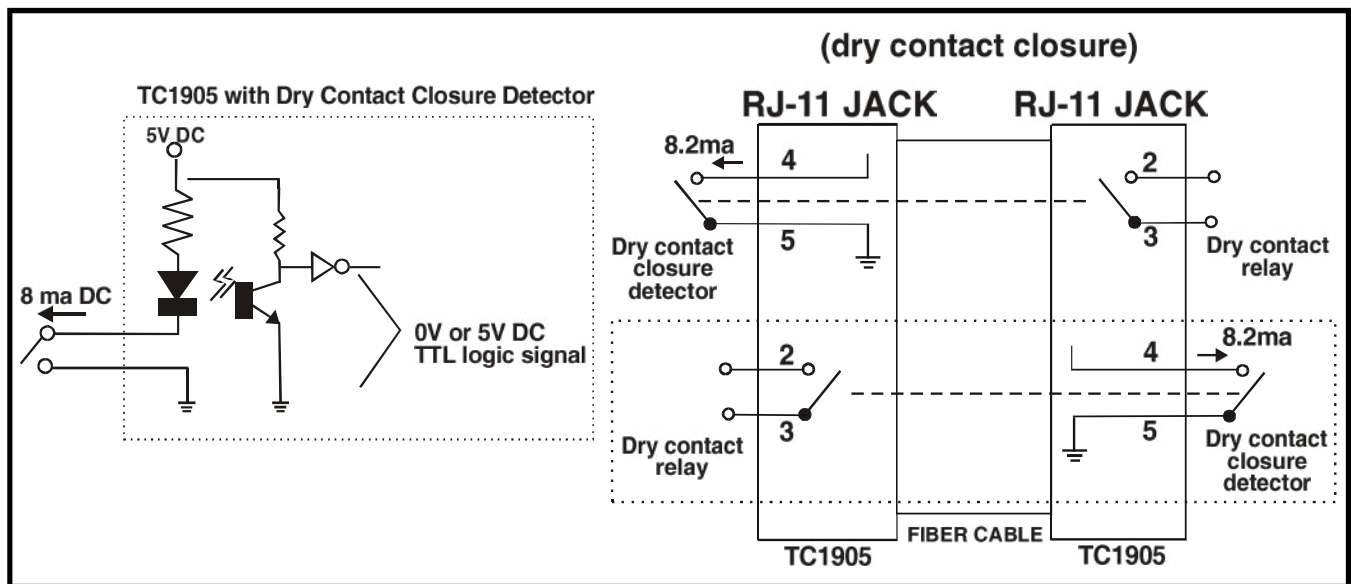


Figure 9. Bi Directional Dry Contact Pin Assignment & Connection Diagrams

## RJ-11 Female Connector and Bi Directional Dry Contact Virtual Pinouts

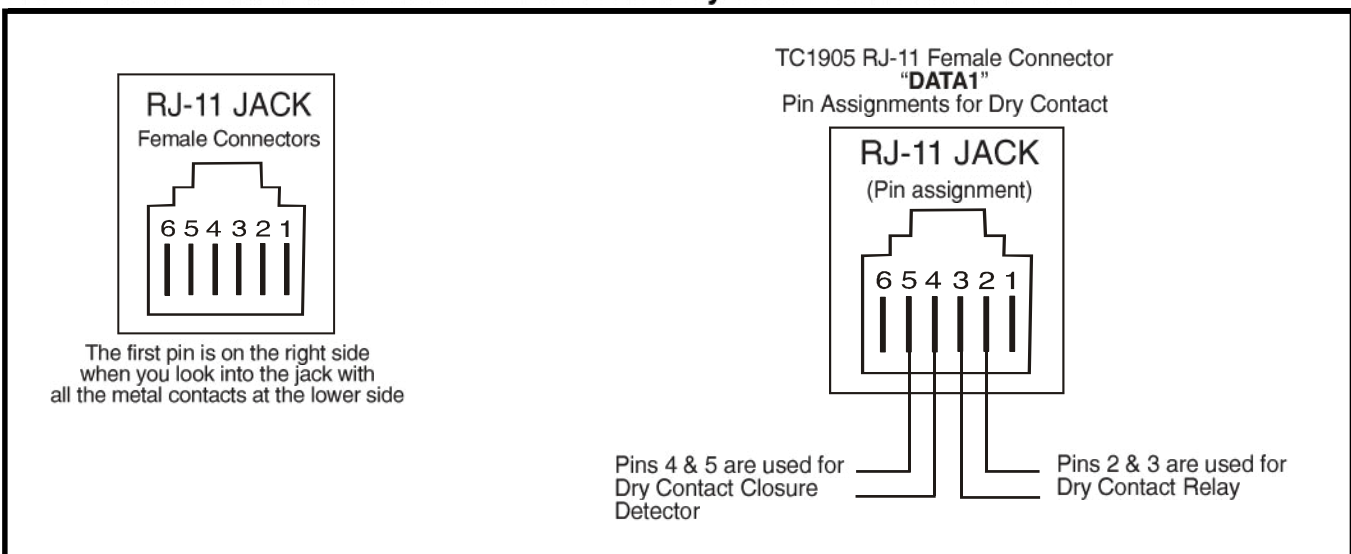


Figure 10. RJ-11 Female Connector and Bi Directional Dry Contact Virtual Pinouts Diagrams

## Unpacking the Unit

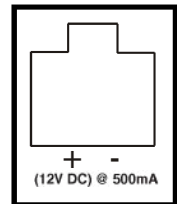
Before unpacking any equipment, inspect all shipping containers for evidence of external damage caused during transportation. The equipment should also be inspected for damage after it is removed from the container(s). Claims concerning shipping damage should be made directly to the pertinent shipping agencies. Any discrepancies should be reported immediately to TC Communications' Customer Service Department.

## Equipment Location

The TC1905 should be located in an area that provides adequate light, work space, and ventilation. Avoid locating it next to any equipment that may produce electrical interference or strong magnetic fields, such as elevator shafts or heavy duty power supplies. As with any electronic equipment, keep the unit from excessive moisture, heat, vibration, and freezing temperatures.

## Power Supply

Each TC1905 unit is powered via a rear panel's terminal block connector. There are two pairs of terminal block connectors ("PWR A" and "PWR B") for power redundancy, the power LEDs on the front panel will light according to which power jack(s) is/are connected. The standard power is 12 VDC @500mA, (24VDC, -48VDC, 125VDC and 115/230VAC with an external power cube are optional).



## Electrical Signal Connections

The RJ-11 connector for phone uses the middle two pins for Tip and Ring, refer to Figure 6 for virtual pin assignments.

For Bi Directional Dry Contact virtual pin connections refer to Figures 9 and 10.

## The DIP Switch Settings and LEDs Status

DIP switch #1 must be set opposite on the local and remote units, one of the units must be a Master and the other a Slave. DIP switch #2, set according to your setup for FXS to FXS, FXO to FXS, or FXO to FXO when using 2/4 wire analog. DIP switch #3, use to change the ring sound. DIP switch #4, use to disable the alarm. DIP switch #5, use to force "off hook" condition (for testing only). DIP switches #6, 7, and 8 are for future releases (not used).

When power is first turned on, all the LEDs should be flashing for about one second. This allows the user to be sure all the LEDs are in working condition.

After one minute, the "alarm" LED should be Off, "PWR A" or "PWR B" or both will be On, "VCCA," "OPT," "SYNC," and "RSNC" will be On, one of "FXS" or "FXO" LEDs should be on to indicate FXO or FXS setup, and the "MSTR" LED should be lit on only one of the units. The flashing green LEDs will turn to solid when abnormal conditions are removed and the red LED (alarm) will be off.

## **System Start Up and Operation for "hotlink"**

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1. Apply the power by plugging the power plug into any power jack on the rear panel. The power source can be from a power adapter or from a power card (installed either on the left or right side of the rack).
2. The "PWR A" or "PWR B" LED on the front panel of the card will light according to which power jack (A or B) is connected. Both LEDs will light when power redundancy is utilized.
3. The "Vcc" LED should be lit, indicating an adequate operating voltage is being derived from the power source.
4. Make sure front panel DIP switches are set correctly according to your application, refer to page 4.
5. Connect the units according to your setup, refer to page 8. If extending a phone line, make sure the RJ-11 cable is connected correctly on the RJ-11 connectors on the rear panel for FXO/FXS. If using a "hot link", make sure to connect to "FXS" RJ-11 connectors on both the local and remote units.
6. Communication is setup between TC1905 peers, the "Alarm" LED will be Off, the green "Sync," and "RSYNC" LEDs should be On to indicate good optic signal is received.
7. Lift up local phone's handset and observe the remote TC1905's "ring" LEDs start to flash.
8. Once the remote phone rings, the remote user can answer the call by picking up the remote handset.
9. When both parties communicate, the front panel "volume" LEDs should indicate the transmit and receive volume.
10. When one of the parties replace the handset to hook to terminate the communication, both units will turn into "idle" state.

*Note: The TC1905 FXS configured unit(s) will ring the phone channel during initialization, and the phone set connected on the FXS channel should ring 10 seconds after power up.*

### **Lightning/Surge Warning Note:**

If copper cable(s) connected to TC1905 unit(s) are located outside buildings or enclosures (even at minimal distances), TC1905 units may be damaged by lightning and/or electrical power surges.

Adding protective devices (surge suppressors/lighting protectors) to each copper cable that is exposed to potential lightning strikes or power surges is highly recommended. Please be aware that adding such protective devices can't guarantee 100 percent protection for connected electronic equipment. You should contact a professional lightning/surge protection consultant for specific questions regarding your application.

## General

The RJ-11 cable connectors are frequently the source of various problems. Check out the connectors, cable, and pin connections first. Once installation of the TC1905s is complete, it is a good idea to perform a bench test to verify that the TC1905s are working properly.

## Local Loopback Testing

Future release.

## Remote Loopback Testing

Future release

## Optic Cable Types

Typically, fiber optic cable with yellow-colored insulation is used for Single Mode applications; gray or orange-colored insulated cable is for Multimode use. If Multimode cable is used in a Single Mode application, the test results could be erroneous and confusing.

## Calculating the Loss on the Fiber

The fiber optic link and/or connectors are frequently the source of various problems. Check out the connectors and the integrity of the link first. Ideally, the link should be calibrated for total loss after the installation has been completed. This will accomplish two things: (1) it will verify that the total loss of the link is within the loss budget of the device and (2) it will provide a benchmark for future testing. For example, a system that has been tested as having 6dB total loss when installed and suddenly tests out as having a loss of 10dB probably has a connector or link problem.

**These are the reference values we use to calculate the loss on the fiber:**

<b>Multimode 850nm</b>	<b>:</b>	<b>3 dB loss per km on 62.5/125µm cable*</b>
<b>Multimode 1310nm</b>	<b>:</b>	<b>2 dB loss per km on 62.5/125µm cable*</b>
<b>Single Mode 1310nm</b>	<b>:</b>	<b>0.5 dB loss per km on 9/125µm cable*</b>
<b>Single Mode 1550nm</b>	<b>:</b>	<b>0.25 dB loss per km on 9/125µm cable*</b>

*\*These numbers are listed for reference only. We recommend an OTDR reading be used to determine actual link loss.*

## Transmission Distances (typical)

The TC1905 will work with all popular sizes and types of fiber. Transmission distances up to 3km\* are typical over Multimode fiber at 850nm and 4km\* at 1300nm. Distances to 80km\* are typical over Single Mode fiber at 1300nm. Transmission distances may vary due to optical loss associated with connectors and fiber optic cable's characteristics.

## Launch Power & Sensitivity

<b>Transmitter:</b>	LED/ELED; typical Launch Power -	-18dBm* (850nm/1310nm MM, @62.5/125µm)
	LASER; typical Launch Power -	-18dBm* (1300nm/1550nm Single Mode, @9/125µm)
		-9dBm* (1300nm Single Mode, @9/125µm)
<b>Receiver:</b>	PIN Diode; typical Sensitivity -	-36dBm* (850nm/1310nm MM, @62.5/125µm)
		-36dBm* (1310nm/1550nm Single Mode, @9/125µm)

*\*Launch power, sensitivity and distance are listed for reference only. These numbers may vary.*

## Audio Bandwidth

Voice Bandwidth ..... 300Hz to 3.4KHz

## Optical

Transmitter ..... LED/ELED/LASER

Receiver ..... PIN Diode

Wavelength ..... 850nm/1300nm Multimode

..... 1300nm/1550nm Single Mode

Fiber Optic connectors ..... ST\*\*, SC or FC\*\*(Optional)

Loss Budget

..... 15dB Multimode 850nm/1300nm @62.5/125 $\mu$ m

..... 20dB Single Mode 1300nm/1550nm @9/125 $\mu$ m

..... Laser 25dB\* Single Mode 1300nm @9/125 $\mu$ m

## Electrical

Connector ..... RJ-11 Female

Ring Frequency ..... 20Hz

Nominal Ringing Voltage ..... 70VRMS

2-Wire Impedance ..... 600 ohm

Ringer Load(Max REN to drive) ..... 3 REN

Voltage between Tip and Ring ..... 48V

Max copper length between phone and the TC1901 ..... 1000 ft(300meters) for 3 REN

Loop current ..... 20mA

Dial ..... Tone only DTMF(Dial Tone Multiple Frequency), not Pulse

## System

Bit Error Rate ..... 1 in 10<sup>9</sup> or better

Visual Indicators ..... PWR A, PWR B, VCCA, VDC, ALM, OPT, SYNC, RSNC,

..... FXS, FXO, MSTR, RMTLB, (TX & RX for Aux. Data),

..... HOOK, RING, (TX & RX for Volume)

Diagnostic Functions ..... RING HK,

..... Signal Generator, Remote Loopback, Local Loopback (future release)

## Power Source

Standard ..... 12VDC @400mA

..... (Optional) 24VDC, -48VDC, 125VDC, or 115/230VAC with external power cube

## Temperature

Operating ..... -10°C to 50°C

..... Hi-Temp Version (optional) -20°C to 70°C

..... Extreme-Temp Version (optional) -40°C to 80°C

Storage ..... -40°C to 90°C

Humidity ..... 95% non-condensing

*Continue on next page.*

**Physical Characteristics (Standalone Unit)**

Height ..... (3.53 cm) 1.4"  
Width ..... (18.14 cm) 7.2"  
Depth ..... (24.89 cm) 9.8"  
Weight ..... (0.907 Kg) 2.0 Lbs.

**Physical Characteristics (for "Pizza Box" with one TC1905 card)**

Height ..... (4.45 cm) 1.7"  
Width ..... (48.3 cm) 19"  
Depth ..... (24.89 cm) 9.8"  
Weight ..... (1.68 Kg) 3.7 Lbs.

*\*Consult factory for higher than 25dB and/or custom interface requirements*

*\*\*ST is a trademark of AT&T Corporation. FC is not available @850nm Multimode.*

# Appendix A

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## Return Policy

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To return a product, you must first obtain a Return Material Authorization number from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please provide a description of the problem and any results of diagnostic tests that have been conducted.

## Warranty

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### Damages by lightning or power surges are not covered under this warranty.

All products manufactured by TC Communications, Inc. come with a five year (beginning 1-1-02) warranty. TC Communications, Inc. warrants to the Buyer that all goods sold will perform in accordance with the applicable data sheets, drawings or written specifications. It also warrants that, at the time of sale, the goods will be free from defects in material or workmanship. This warranty shall apply for a period of five years from the date of shipment, unless goods have been subject to misuse, neglect, altered or destroyed serial number labels, accidents (damages caused in whole or in part to accident, lightning, power surge, floods, fires, earthquakes, natural disasters, or Acts of God.), improper installation or maintenance, or alteration or repair by anyone other than Seller or its authorized representative.

Buyer should notify TC Communications, Inc. promptly in writing of any claim based upon warranty, and TC Communications, Inc., at its option, may first inspect such goods at the premises of the Buyer, or may give written authorization to Buyer to return the goods to TC Communications, Inc., transportation charges prepaid, for examination by TC Communications, Inc. Buyer shall bear the risk of loss until all goods authorized to be returned are delivered to TC Communications, Inc. TC Communications, Inc. shall not be liable for any inspection, packing or labor costs in connection with the return of goods.

In the event that TC Communications, Inc. breaches its obligation of warranty, the sole and exclusive remedy of the Buyer is limited to replacement, repair or credit of the purchase price, at TC Communications, Inc.'s option.

To return a product, you must first obtain a Return Material Authorization (RMA) number and RMA form from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please fill out RMA form provided with a description of the problem(s) and any results of diagnostic tests that have been conducted. The shipping expense to TC Communications should be prepaid. The product should be properly packaged and insured. After the product is repaired, TC Communications will ship the product back to the shipper at TC's cost to U.S. domestic destinations. (Foreign customers are responsible for all shipping costs, duties and taxes [both ways]. We will reject any packages with airway bill indicating TC communications is responsible for Duties and Taxes. To avoid Customs Duties and Taxes, please include proper documents indicating the product(s) are returned for repair/retest).

## Limitation of Liability

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In no event shall the total liability of TC Communications, Inc. to purchaser and/or end user for all damages including but not limited to compensatory, consequential and punitive damages, exceed the total amount paid to TC Communications, Inc. by purchaser for the goods from which the claim arose, in no event shall TC Communications, Inc. be responsible for indirect and consequential damages.

*Continue on next page.*



## **Limitation of Liability (Cont.)**

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In no event shall liability attached to TC Communications, Inc. unless notice in writing is given to TC Communications, Inc. within ten days of the occurrence of the event giving rise to such claim.

TC Communications, Inc. shall not be responsible for delays or non-deliveries directly or indirectly resulting from or contributed to by foreign or domestic embargoes, seizure, fire, flood, explosion, strike, act of God, vandalism, insurrection, riot, war, or the adoption or enactment of any law, ordinances, regulation, or ruling or order or any other cause beyond the control of TC Communications, Inc.

TC Communications, Inc. shall not be responsible for loss or damage in transit and any claims for such loss or damage shall be filed by the purchaser with the carrier.

## Glossary

FXO-Foreign Exchange Office.

FXO configuration is required for a plain old telephone service (POTS) to generate a call to the telephone network.

FXS-Foreign Exchange Station.

FXS configuration is required for a telephone network to generate a call to a plain old telephone set.

Hotlink-direct connected phone line.

PBX-Private Branch Exchange.

A telephone exchange device owned by private entity.

Ringdown-provide ringing signal.

Toll quality voice-voice frequency is restricted within 300Hz to 3.4KHz.